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THE FIVE PHASES OF THE INTERNET OF THINGS



WHITE PAPER

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1. Introduction

Our lives are changing in exciting ways. Devices in our homes, automobiles, cities, and factories are becoming connected to the Internet, and this phenomenon has profound implications for businesses. Connected product offerings can lead to increased revenue, reduced expenses, and a more engaged customer base. In fact, the Internet of connected products movement is not behind us – it is just beginning, and the possibilities are virtually endless.

Some industry estimates predict there will be 20+ billion connected devices online by 2020, representing an overall Internet of Things (IoT) market size of \$200+ billion. Other studies have predicted much higher growth than this, suggesting the annual IoT global economic value will exceed the US GDP by 2025.

Although it is difficult to say which estimates will be most accurate, one thing is certain: growth in IoT is happening, and companies are investing. A recent [Economist Intelligence Unit survey](#)¹ sponsored by ARM indicated that 95% of companies expect to be using IoT within three years. Additionally, 63% of respondents believe companies without an IoT strategy will fall behind. Of all companies surveyed, 40% are currently researching IoT and 17% have concrete plans to roll out an IoT solution in the near future. Figure 1.1 details this opportunity surrounding IoT over the next few years.

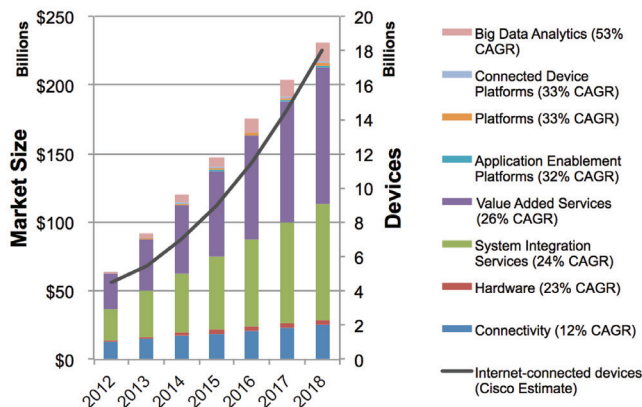


FIGURE 1.1: THE IOT OPPORTUNITY²

The massive projected growth in IoT can only be unlocked if real businesses can create real IoT product solutions and get them to market in a timely fashion. If businesses are not able to effectively deliver IoT solutions, the market will never achieve the great heights that industry analysts are predicting.

As the IoT groundswell grows, it will unfold in the following five phases of maturity:

1. POINT SOLUTIONS
2. GENERALIZED DATA PLATFORM PRODUCTS
3. VERTICAL INDUSTRY SOLUTIONS
4. INHERENTLY CONNECTED BUILDING BLOCKS
5. STANDARDIZED ACCESS

Each phase builds on the previous phase and must occur in sequence in order for small, medium, and large businesses to effectively integrate IoT into the enterprise. As shown in Figure 1.2, the industry is currently in phase three.

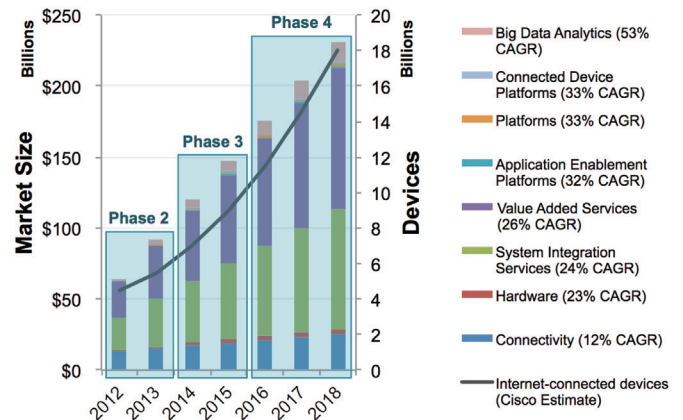


FIGURE 1.2: PHASES OF THE IOT OPPORTUNITY³

Phase four and beyond cannot be unlocked without the wide availability of inherently connected building blocks like smart integrated circuits, interoperability standards, cloud-ready gateways and network aggregators, device provisioning services, and federated cloud services to enable business intelligence and better decision making by business leaders. This white paper provides a detailed description of each phase of IoT maturity.

2. Five Phases of IoT

2.1 POINT SOLUTIONS

Prior to 2012, as the industry began to see the power of Machine to Machine (M2M) communications as it relates to people's lives and the efficiency gains that could be realized in businesses by connecting devices over the Internet, the term Internet of Things was coined. During this period, customized M2M/IoT products were created. With the creation of each new product, developers designed hardware, invented networking protocols, wrote web server applications, and customized everything. Reuse of concepts and technology was minimal.

Building customized M2M/IoT products was effective, but the solutions were expensive and not easily reusable for adjacent industries. Because of this, a problem arose that is identified here as the micro-vertical challenge. The micro-vertical challenge is shown in Figure 2.1 that depicts the long tail of product design as it applies to IoT.

¹ http://www.arm.com/files/pdf/EIU_Internet_Business_Index_WEB.PDF

² Source: ABI Research, Cisco, Craig Hallum Estimates

³ Source: ABI Research, Cisco, Craig Hallum Estimates

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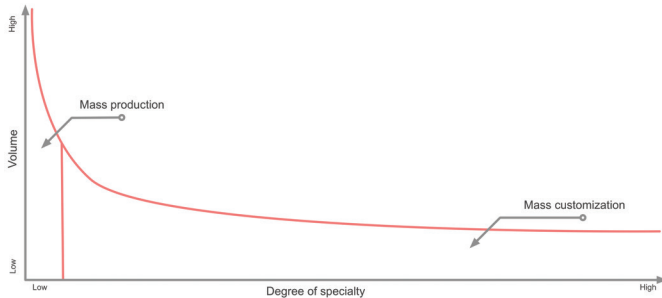


FIGURE 2.1: MICRO-VERTICAL CHALLENGE

The long tail of IoT refers to the statistical distribution of connected products in two dimensions: volume and degree of specialty. Examples of high-volume products are cell phones, wearables, tablets, and personal computers. These products are sold in massive numbers and are used by a wide variety of people. In the figure above, this portion of the long tail is labeled “mass production” and is also sometimes called the “head” of the distribution.

Counter to devices in the “mass production” category are those that are produced in lower volume and are applicable to a more narrow audience. Connected products in this category are things like industrial sensors, factory equipment, medical devices, pumps and motors, and generators – anything that is not a “mass production” device. In the figure above, this portion of the long tail is labeled “mass customization” and is also sometimes called the “tail” of the distribution.

The reason the long tail of IoT is important to understand is that in order for the massive growth of IoT to reach its potential, it cannot depend only on the mass production of common consumer devices. In order to truly unlock the potential of IoT, original equipment manufacturers (OEMs) must be able to create connected products that are shipped in low volume (less than one million units) with low engineering investment (less than one million dollars).

2.2 GENERALIZED DATA PLATFORM PRODUCTS

Starting in 2010, the industry realized that there was potential in creating more generalized data platform products and services that could be leveraged across the entire long tail of niche connected products. Why reinvent the wheel when a centralized software product could be used to receive/store data and send out events/alerts based on pre-defined conditions?

During this time, forward-thinking entrepreneurs like Exosite began developing software platforms that could perform common functions that were necessary across many industry verticals. These functions included things like device provisioning and management, time series data storage, stream data processing, data visualization and reporting, and the ability to send events and alerts based on pre-defined conditions and algorithms. An illustration of this trend is shown in Figure 2.2.

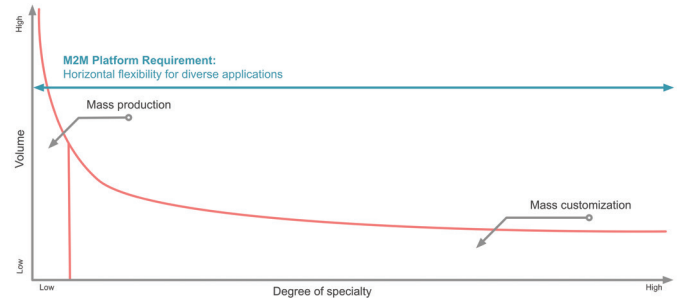


FIGURE 2.2: HORIZONTAL FLEXIBILITY FOR DIVERSE APPLICATIONS

Exosite's IoT cloud platform consists of device Activator™ embedded firmware, hardware partners, One Platform™ device and data management, and Portals™ user management and data visualization framework. These products are combined with open application programming interfaces (APIs) that enable customized web and mobile application development and the ability to interface with existing business systems to provide an industry-leading set of building blocks to create IoT solutions. See the [Exosite Technology Overview white paper](http://exosite.com/whitepapers/)⁴ for more information about these software product offerings.

2.3 VERTICAL INDUSTRY SOLUTIONS

In 2013, the industry began to understand that in order to penetrate a larger part of the market, vertical-specific industry solutions must be developed. Fleet tracking has been around for some time and is perhaps the best example of a success story in this area. Fleet tracking is the pattern by which other industries are beginning to package vertical-specific industry solutions (e.g., generator monitoring), while remaining flexible enough to meet the needs of almost any company that makes or monitors generators.

In this phase of IoT maturity, an analogy to drilling oil wells can be used to describe the process of creating vertical solutions. In this paradigm, the players that can drill holes quickly (create full vertical solutions) and with high quality will extract the most value. Successful vertical solutions must be quickly deployable and engage the full range of IoT technologies to address the vertical market segment (sensors, devices, gateways, short-range RF networks, network aggregators, long-range RF networks, software platforms, web/mobile user interfaces, and integration with other business systems). Figure 2.3 provides a depiction of this phase of IoT maturity.

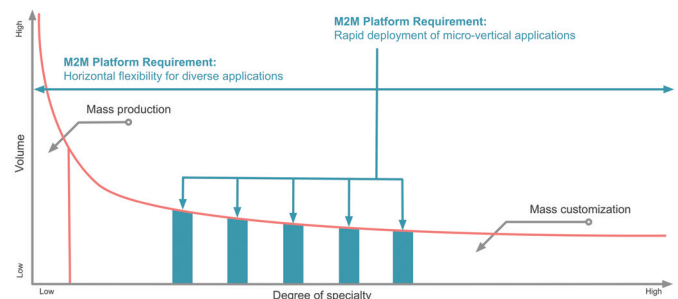


FIGURE 2.3: RAPID DEPLOYMENT OF MICRO-VERTICAL APPLICATIONS

⁴ <http://exosite.com/whitepapers/>

To help customers quickly create full vertical industry solutions, Exosite has developed a Micro Vertical Engine™ approach that enables customers to easily build IoT businesses using three pillars:

1. ZERO BARRIERS

Exosite-enabled hardware building blocks remove the barrier to entry for OEMs designing IoT products. IoT concepts such as security, data aggregation, IP communications, identity management, remote firmware updates, and ownership are integrated into these building blocks, allowing OEMs of all technology proficiencies to create disruptive cloud-connected products.

2. INFINITE ACCESS

A variety of open, proven, and standardized public APIs allow customers to securely access and integrate their data with any business system or web service.

3. IMMEDIATE VALUE

By using Exosite Portals™ and its integrated business-to-consumer (B2C) billing system, it is quick and easy to create IoT businesses that generate revenue right from the start.

In addition to products, Exosite also provides training and consulting services to help customers navigate the tricky landscape of IoT technologies, standards, and business models with the goal of quickly developing industry-disrupting solutions that can be extended and replicated. [Contact Exosite](#) for more information.

2.4 INHERENTLY CONNECTED BUILDING BLOCKS

One of the biggest challenges to create connected product solutions for IoT is the number and variety of technologies that must be integrated. The range of software skills required spans information technology (IT), web technologies, and embedded development – depth in this range of skills is not typically found in a single company, let alone a single individual. Rather, it requires the coordination of a team effort in which a significant portion of development time and money is spent on integrating the pieces (e.g., sensors, devices, gateways, networks, servers, user interfaces, business systems).

For the IoT industry to mature to phase four, inherently connected building blocks must be created that make it easy for companies to integrate the diverse technologies required for an IoT solution. Inherently connected building blocks include cloud-connected integrated circuits, cloud-aware modems, standardized device communication protocols, IPV6 for resource-constrained devices, mesh networking protocols and implementations, cloud-aware gateways and network aggregators, low-bandwidth and long-range transport protocols, and interoperability standards for federating clouds together.

In order for inherently connected building blocks to make a difference in the IoT landscape, each aspect of the IoT value chain must be developed such that cloud connection is easy, secure, cost effective, and reliable. In addition, considerable industry consensus must be developed to allow inherently connected

building blocks to speak to each other and interoperate in a way that is reliable, secure, and easy to use. Figure 2.4 depicts how inherently connected building blocks can disrupt the IoT movement.

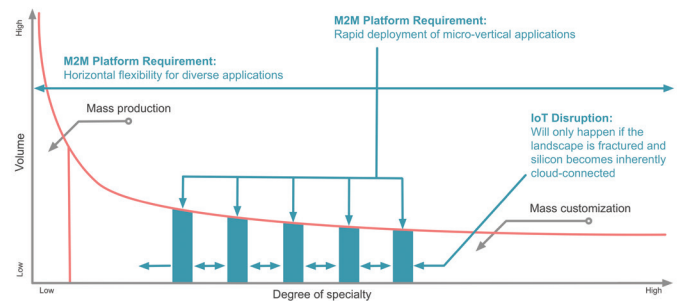


FIGURE 2.4: BUILDING BLOCKS DISRUPT IOT MOVEMENT

Exosite's partnership, product, and service roadmap emphasizes interoperable, inherently connected building blocks. By making embedded microcontrollers inherently connected, product designers can focus on developing IoT products and spend less time worrying about secure communications, device provisioning, firmware over the air (FOTA) updates, manufacturing integration, and fleet management. [Contact Exosite](#) for more information about cloud-connected building blocks.

2.5 STANDARDIZED ACCESS

Only after the first four phases of IoT maturity have been completed can the fifth phase of IoT be realized. In the fifth phase, market segment-based standards for data will begin to mature, allowing customers and businesses to obtain standardized access to devices and device data. During this phase, the emphasis and importance of physical devices will be reduced; instead, common device registries, interchangeable data-processing algorithms, and the co-alignment of artificial and business intelligence will become a reality. Figure 2.5 provides a depiction of the effect of standardized access on the IoT industry.

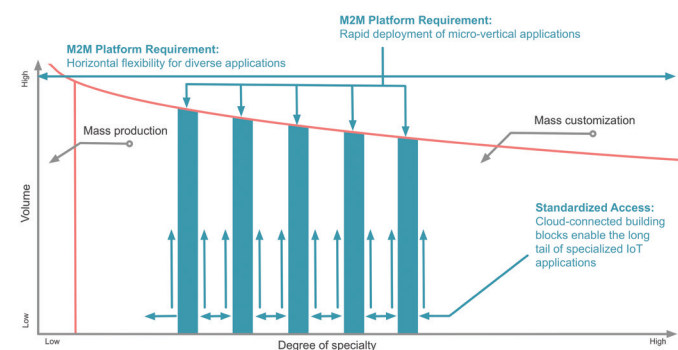


FIGURE 2.5: EFFECT OF STANDARDIZED ACCESS ON IOT INDUSTRY

Exosite understands that IoT standards are currently fragmented, but in the future will become critical to achieving the full promise of IoT. Exosite participates in key IoT standards bodies, provides critical thought leadership in the marketplace, and is helping to lead the industry with standards-based solutions like the Exosite Constrained Application Protocol (CoAP) Activator™ software and server-side functionality.

3. Conclusion

It is clear that the world of IoT is poised to grow at a massive pace. This growth will happen not in just one industry, but rather in many industries. In order for the full potential of IoT to be unlocked, the industry must progress through a series of maturity phases that will produce a new world of connected products and data that will make businesses more effective, create new economies, and enable better lives.

Are you ready? [Contact Exosite](#) to discuss how we can help you lead your company into the IoT generation of business.



Exosite's cloud-based services provide companies with the technology needed to build and deploy next-generation IoT applications that leverage the expanding world of connected devices. Customers all over the world use Exosite to build custom remote monitoring and control solutions that meet the demands of their connected products, which in turn improves uptime, reduces maintenance costs, and increases value-added service offerings.